Integrated Rate Law (Note: You will need to use Excel for this homework assignment)

1. The following data were obtained for the gas-phase decomposition of nitrogen dioxide at 300°C,

$$NO_2(g) \rightarrow NO(g) + \tfrac{1}{2}O_2(g)$$

Time (s)	$[NO_2](M)$
0.0	0.01000
50.0	0.00787
100.0	0.00649
200.0	0.00481
300.0	0.00380

Is the reaction zero, first, or second order?

Considering the same reaction above, but with a starting concentration of nitrogen dioxide of 0.500*M*. What would be the remaining concentration of NO_2 after 0.500 hr?

2. The first-order rate constant for the decomposition of N_2O_5, $N_2O_5(g) \rightarrow 2NO_2(g) + 1/2O_2(g)$, at 70°C is $6.82 \times 10^{-3} s^{-1}$. Suppose we start with 0.00250 moles of N_2O_5 in a constant volume of 2.0L.

a) How many moles of N_2O_5 will remain after 2.5 min?
b) How many minutes will it take for the quantity of N_2O_5 to drop to 0.0010 mol?
c) What is the half-life of N_2O_5 at 70°C?

3. At 500K in the presence of a copper surface, ethanol decomposes according to the equation:

$$C_2H_5OH(g) \rightarrow CH_3CHO(g) + H_2(g)$$

The pressure of the ethanol was measured as a function of time and the following data were obtained:

Time (s)	P of C_2H_5OH (torr)
0.0	250.
100.0	237
200.0	224
300.0	211
400.0	198
500.0	185

Since the pressure of a gas is directly proportional to the concentration of a gas, we can express the rate law for a gaseous reaction in terms of partial pressures. Using the data above, deduce the rate law, the integrated rate law, and the value of the rate constant, all in terms of pressure units in atm and time in seconds. Predict the pressure of C_2H_5OH after 900. s from the start of the reaction.